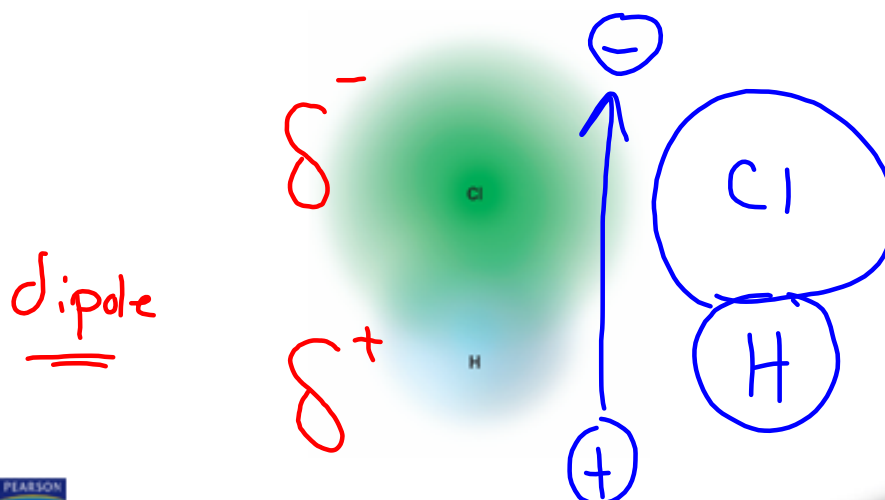


The chlorine atom attracts the electron cloud more than the hydrogen atom does.



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#### 9.4 Polar Bonds and Bond Polarity

**Table 8.3**

**Electronegativity Differences and Bond Type**

| Electronegativity difference range | Most probable type of bond |
|------------------------------------|----------------------------|
| 0.0–0.4                            | Nonpolar covalent          |
| 0.4–1.0                            | Moderately polar covalent  |
| 1.0–2.0                            | Very polar covalent        |
| ≥ 2.0                              | Ionic                      |

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**Molecules**

In a **polar molecule**, one end of the molecule is slightly negative and the other end is slightly positive.

A molecule that has two poles is called a **dipolar molecule**, or **dipole**. Ex: HCl


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**8.4** Polar Bonds and Molecules > Attractions Between Molecules

 **Intermolecular attractions are weaker than either ionic or covalent bonds.**

These attractions are responsible for determining whether a molecular compound is a gas, a liquid, or a solid at a given temperature.

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8.4 Polar Bonds and Molecules > Attractions Between Molecules

## Van der Waals Forces

The two weakest attractions between molecules are collectively called **van der Waals forces**, named after the Dutch chemist Johannes van der Waals (1837–1923).

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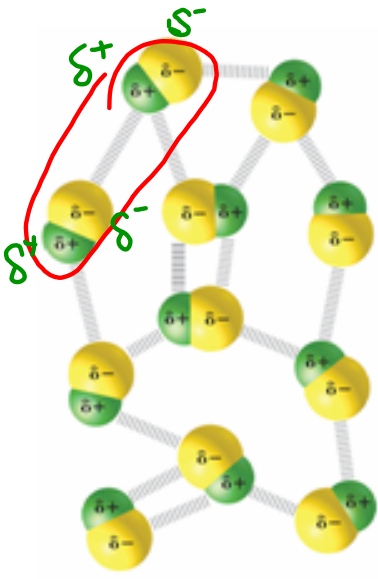
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8.4 Polar Bonds and Molecules > Attractions Between Molecules

## Dipole interactions

occur when polar molecules are attracted to one another.



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MOLECULES

**Dispersion forces**, the weakest of all molecular interactions, are caused by the motion of electrons.

The strength of dispersion forces generally increases as the number of electrons in a molecule increases.

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**8.4** Polar Bonds and Molecules > Attractions Between Molecules

**Hydrogen Bonds**

**Hydrogen bonds** are attractive forces in which a hydrogen covalently bonded to a very electronegative atom is also weakly bonded to an unshared electron pair of another electronegative atom.

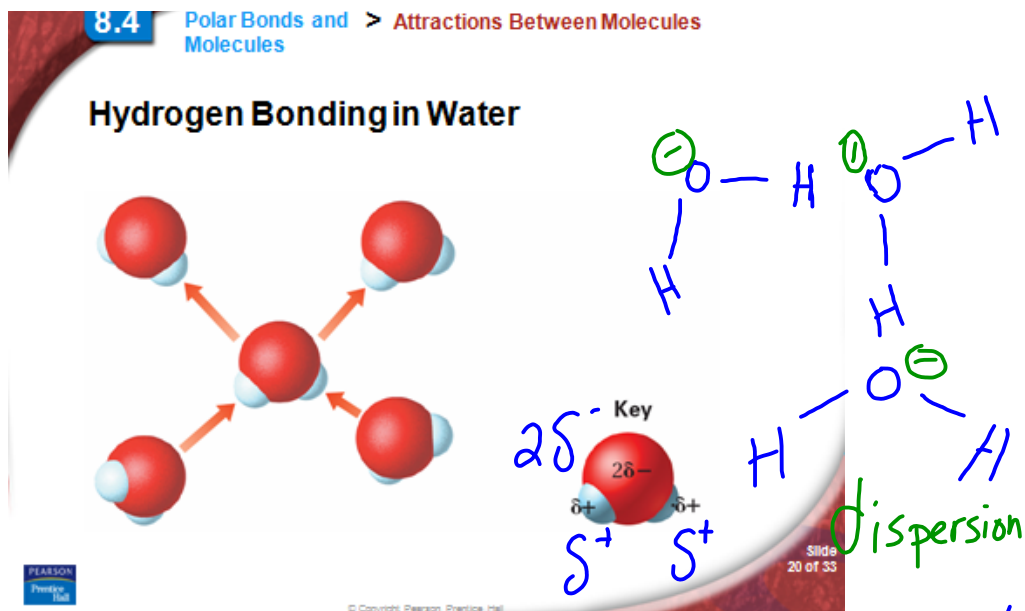
→ a special kind of dipole force involving hydrogen

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Forces

Ionic Covalent H bonding dipole-dipole dispersion

Strongest bonds → weakest intermolecular forces

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| Intermolecular Forces-Between Molecules. There are three types of forces BETWEEN MOLECULES: |               |                       |
|---|---------------|-----------------------|
| Dispersion  | DIPOLE-DIPOLE | HYDROGEN BONDS        |
| -Boiling point  | -solubility   | -Strong dipole forces |
|   |               |                       |

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